

Everyone is normal: Consistent livestock management norms and demographic clusters in Kenya and Zimbabwe

Laura R. Perry¹  | Tom P. Moorhouse¹ | Lovemore Sibanda¹  |
Steiner L. Sompeta^{1,2} | David W. Macdonald¹ | Andrew J. Loveridge¹

¹Wildlife Conservation Research Unit,
Zoology Department, University of
Oxford, Oxford, UK

²South Rift Association of Land Owners,
Nairobi, Kenya

Correspondence

Laura R. Perry, Wildlife Conservation
Research Unit, Zoology Department,
University of Oxford, Tubney House,
Abingdon Rd., Oxford OX13 5QL, UK.
Email: laura.perry@zoo.ox.ac.uk

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Abstract

Human behavior often determines the success of conservation projects, and the emerging discipline of conservation psychology focuses on understanding and influencing this behavior. Social norms (a group's perception of the appropriateness of behaviors) are a key influence on human behavior, and social norms campaigns can often engender population-wide behavior changes. Human-predator conflict is a major conservation issue, and one in which human behavior plays a substantial role: high standards of livestock management can considerably lower predation levels. In this paper, we use factor analysis to show that the livestock management normative belief structure of rural livestock owners is highly conserved between populations in Kenya and Zimbabwe. Through cluster analysis, we also show that qualitatively distinct attitudinal groups can be identified, and that some of these groups are common to both regions. Researchers often assume that social landscapes are unique, but we show that this is not the case for livestock management norms. People's attitudes are also generally assumed to be site-specific, but we found commonalities across different regions, indicating that certain attitude sectors may be present in all livestock-owning populations. If livestock management norms and attitude groups are indeed highly conserved between regions, it may be possible to develop standardized tools with which to understand the norms that influence livestock management behavior, and identify population sectors for targeted interventions. Often, conservation projects have little in-house social science expertise, and social studies are avoided despite the benefits they bring. Here, we demonstrate that standardized approaches may be possible, and could aid the implementation—and success—of conservation interventions.

KEYWORDS

conservation psychology, livestock management, human–wildlife conflict, livestock predation, social norms

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1 | INTRODUCTION

Various factors govern how people behave, and social and behavioral psychology explore these factors. Growing bodies of work outside psychology are also devoted to exploring decision-making as it relates to specific activities: behavioral economics, for example, explores individual decision-making (Earl, 1990), sociological research examines how culture influences social behavior (Giddens, Duneier, Appelbaum, & Carr, 1991); and market research focuses on people's preferences and the reasons behind them (Sarstedt & Mooi, 2014). Although human decision-making and behaviors impact everything from recycling to poaching, relatively little research in the conservation realm has explored the psychological and social processes that impact conservation issues.

One of the key psychological influences on human behavior are social norms, which can be defined as a group's perceptions of the social appropriateness of behaviors: how people believe others behave, and in turn how others perceive their own behavior (Cialdini & Trost, 1998). At their core, norms influence behavior by indicating to individuals that a particular choice is common (and therefore desirable), or uncommon (and therefore undesirable). These social standards have pervasive impacts across all arenas of life, often with serious consequences: men with rigid perceptions of masculinity are more likely to be violent towards their partners (Barker, Ricardo, Nascimento, Olukoya, & Santos, 2010), and public acceptance of military force is leading to a gradual proliferation of private military companies (Krahmann, 2013). Campaigns to influence social norms can be effective at eliciting behavior change, and have been credited with reducing drinking (Perkins & Berkowitz, 1986); decreasing sexism (Kilmartin et al., 2008); and reducing risk of suicide (Silk, Perrault, Nazione, Pace, & Collins-Eaglin, 2017). As a powerful tool for understanding and influencing behavior, norms have huge applicability to conservation issues, and have been successfully used to promote energy conservation (Wong-Parodi, Krishnamurti, Gluck, & Agarwal, 2019) and charitable giving (Lindersson, Guntell, Carlsson, & Agerström, 2019).

For predator conservation in many parts of Africa, livestock predation and the associated conflict with predators lead to various human-wildlife conflict (HWC) issues: predation of livestock is a significant source of hardship for families (Thirgood, Woodroffe, & Rabinowitz, 2005), and retaliatory killings can have significant impacts of predator populations (Kissui, 2008). Poor livestock management practices often contribute to

these issues, and a variety of management techniques including daytime herding, overnight shelters, and livestock guardian animals have been shown to reduce losses to predators (Loveridge et al., 2017; Ogada, Woodroffe, Oguge, & Frank, 2003; Potgieter, 2011). However, despite the benefits brought by these approaches, communities can be resistant to implementing them, and mechanisms to increase uptake are needed. Previous work has shown that livestock management decisions can be modelled using a psychological framework, and suggested that normative beliefs may influence individuals' livestock management decisions (Perry, Moorhouse, Loveridge, & Macdonald, 2019). In this paper, we explore whether studying the normative beliefs of livestock managers can provide information that is useful in the design of effective interventions to improve husbandry and reduce conflict with predators. To establish how easily norm surveys can be used in different locations, we first investigate regional variation in normative belief structure. Understanding norm stratification may be key to designing effective social norms campaigns, which identify and target different sectors of a population. To understand if—and how—populations can be stratified in this way, we then explore clustering in the survey population, to understand how different demographic, social, and attitude factors may influence individuals' normative beliefs.

2 | METHODS

2.1 | Study areas

Two regions were selected for this study: western Zimbabwe, on communal land adjacent to Hwange National Park (HNP), and southern Kenya, along the Tanzanian border. The area around HNP is characterized by low fertility soils and erratic rainfall. Subsistence farming of maize (*Zea mays*), sorghum (*Sorghum bicolor*) and millet (*Pennisetum glaucum*) are the main agricultural activities (Guerbois, DUFOUR, Mtare, & Fritz, 2013). This area has historically benefitted from wildlife tourism, but Zimbabwe's ongoing economic and political crises have vastly diminished the tourism industry (Guerbois et al., 2013). Culturally, the people are a mix of Ndebele, Nambya, and some Tonga, and have been politically and socially marginalized in Zimbabwe (Eppel, 2008). People around Hwange keep cattle (*Bos taurus*), donkeys (*Equus asinus*), and some small stock, and the Ndebele people in particular have a long history of livestock production (Loveridge, Kuiper, et al., 2017). The largest national park in Zimbabwe, HNP has populations of lion

(*Panthera leo*), leopard (*Panthera pardus*), and other predators.

In Kenya, data were collected across the South Rift area and the Tsavo-Amboseli ecosystem, which lie along the Tanzanian border. Across the region, rainfall is low and bimodal, and soil types range from swamp and waterlogged grumosols to sandy and arid; overall, the area can be described as arid to semi-arid (Schuette, Wagner, & Creel, 2013). Traditionally, people in the area are pastoralists, and make use of shifting wet/dry season grazing patterns to accommodate the seasonal landscape. However, sedentarization and land fragmentation have been occurring since the 1960s, and influx of immigrant crop farmers contributes to the changing landscape (Kioko & Okello, 2010). The area is predominantly Maasai, and livestock management is largely traditional. Southern Kenya holds some of the county's most visited national parks, including the Maasai Mara, Amboseli, and Tsavo. The area is a largely contiguous rangeland system, with resident populations of predators.

Southern Kenya and western Zimbabwe experience locally high levels of conflict with predators, typically as a consequence of livestock predation (Hazzah et al., 2014; Loveridge, Valeix, Elliot, & Macdonald, 2017; Western, 2017). Both regions have strong cultural ties to livestock production, but traditional livestock management techniques are notably different, as are modern changes to management, with agro-pastoralism and sedentarization the primary changes in Zimbabwe and Kenya respectively. In both areas, a significant proportion of livestock predation occurs at night; to reduce the vulnerability of livestock animals, they are often brought into overnight shelters (here referred to as “bomas”). For the purposes of this study, the regions have enough similarity (in their history of livestock production, and exposure to conflict) to be comparable, and sufficient differences (ethnic backgrounds, models of livestock management, and adaptations to the 21st century) that conclusions which can be drawn across both sites—or tools which perform well in both areas—should be readily applicable to livestock management conflict situations across sub-Saharan Africa.

2.2 | Survey participants and collection protocol

Survey protocol was approved by the University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (Reference No. R53944/RE001). Survey questions were pre-translated into Maa, Kiswahili, Ndebele, and Nambya through group discursive processes, with translate-retranslate methodology

where translations were imprecise or there was poor consensus (Lucas & Ware, 1977; Perry et al., 2019). Each survey was conducted as a face-to-face structured interview by trained local research assistants, in the preferred language of the respondent. Survey responses were recorded using the Qualtrics offline survey application (Qualtrics, 2013), which formats surveys to be administered as a mobile application. Research assistants operated in their local area, using door-to-door surveying or opportunistic meetings at communal spaces, for example, markets. As this study concentrated on livestock management, all participants were or had previously been involved in livestock management, through owning, herding, or otherwise attending to livestock, and were over the age of 16. Although livestock management is relatively gendered in both Kenya and Zimbabwe, and it is uncommon for women to be responsible for livestock, in this study all participants are or were livestock managers; often, female respondents were the heads of their respective households as either single parents or widows. Data used in this paper were collected as part of a larger survey, which was conducted between March and September 2018 in Kenya, and October 2018 and January 2019 in Zimbabwe. Data collection was constrained by the field seasons in each location, and sample sizes were not representative of the total population size. Overall, we collected 740 and 242 usable sets of data from Kenya and Zimbabwe, respectively.

2.3 | Survey design

The principal survey components used in this study related to demographic and social attributes, and normative beliefs. Demographic components ($n = 6$) were age, sex, ownership of livestock, education, social standing, and access to food. Normative components ($n = 14$) concerned perceptions of herding, use of an overnight shelter (boma), local livestock management standards, and persecution of predators. For normative questions, responses took the form of either a 5-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree), or a 5-point quantity scale (all, a lot, a moderate number, a few, none; see Table 1). Normative belief questions covered the core normative belief types: injunctive norms (socially demanded/forbidden; (Cialdini & Trost, 1998)); descriptive norms (prevalence of behavior; (Cialdini & Trost, 1998)) and subjective norms (behavior or opinions of key actors or groups; (Ham, Jeger, & Frajman Ivković, 2015)); here we consider family, friends, community leaders, and wealthy citizens of the respective countries as key

TABLE 1 Normative belief questions

Statement	Norm type	Response code
My community feels my livestock should be brought into a Boma every night.	Injunctive	Likert
People expect me to bring my livestock into a Boma every night.	Descriptive	Likert
The people I care about bring their livestock into a Boma every night.	Subjective	Likert
My community feels my livestock should be herded every day.	Injunctive	Likert
People expect I will herd my livestock every day.	Descriptive	Likert
The people I care about herd their livestock every day.	Subjective	Likert
Community elders think it is important for me to manage my livestock well.	Subjective	Likert
My friends think it is very important for me to manage my livestock well.	Subjective	Likert
How many people in your community manage their livestock well?	Descriptive	Quantity
How many people in other areas manage their livestock well?	Descriptive	Quantity
How many wealthy/successful Kenyans manage their livestock well?	Descriptive	Quantity
My community feels I should kill any predators that kill livestock.	Injunctive	Quantity
The people I care about kill predators that kill livestock.	Subjective	Quantity
People expect that I will kill any predators that kill my livestock.	Descriptive	Quantity

Note: Injunctive norms relate to behavior that a group considers obligatory: *should/should not*. Descriptive norms relate to behavior that a group believes is taking place: *do/do not*. Subjective norms relate to the behavior or opinions of key individuals/groups, for example, family or community elders. Likert codes: strongly agree; agree; neither agree nor disagree; disagree; strongly disagree. Quantity codes: all; a lot; a moderate number; a few; none. Response codes were tested in both regions for comprehension and meaning.

referents). Survey components regarding control beliefs ($n = 10$) were also used in part A (see supplementary materials).

2.4 | Data analysis

All analysis was carried out using the free statistical software R, version 3.5.1 (Team, 2015). R packages which were used are noted where relevant.

2.4.1 | Part a: Normative belief structures in Kenya and Zimbabwe

We wished to explore whether the structure of normative beliefs was the same in Kenya and Zimbabwe, using data on livestock management norms and control beliefs. Psychological beliefs cannot be measured directly; instead survey questions are mapped against underlying latent beliefs using Factor Analysis, a form of Principal Components Analysis (“psych”, (Revelle & Revelle, 2015)). For this analysis, we used a subset of the normative belief survey questions that excluded the predator control questions, which we expected to vary more between regions, and were not central to the core norms survey ($n = 11$). We determined the factor structure of normative beliefs in the Kenyan data using a Factor Analysis with varimax rotation, which rotates the factors in multi-dimensional space to identify the simplest factor mapping. To compare belief structures, we constrained each data set to a standardized number of factors, and then compared the characteristics of these factors between the two different data sets. As four factors fitted the Kenyan data best, and this was the larger data set, we also constrained the Zimbabwe data to four factors. The factor sets from the Kenyan and Zimbabwean data were then compared for attribute similarity using a Tucker coefficient test (R package “RegularizedSCA,” (Gu & Van Deun, 2017)). With this test, a similarity of ≥ 0.95 indicates factor structures are virtually identical; 0.85–0.94 is considered a fair fit, and < 0.85 indicates no significant similarity. We also carried out the same process with the control belief data ($n = 10$) from both Kenya and Zimbabwe, to examine whether all psychological factor structures had a comparable level of similarity between regions.

2.4.2 | Part B: Normative belief clusters in Kenya and Zimbabwe

In this analysis, we wished to examine whether social, demographic, or attitude-based attributes could be used to describe qualitatively different normative attitude types. To do so, we used all normative questions from the survey ($n = 14$), and applicable demographic questions ($n = 6$). Data units were then scaled, and a cluster analysis performed (“cluster”, (Maechler, Rousseeuw, Struyf,

Hubert, & Hornik, 2012)). To determine the optimal number of clusters, we ran all suitable methods for determining optimal cluster number (“factoextra,” (Kassambara & Mundt, 2017); “NbClust,” (Charrad, Ghazzali, Boiteau, & Niknafs, 2012)). Across 23 different methods, seven approaches recommended using two clusters, and five recommended six clusters; however, averaging across all methods, a higher number of clusters was statistically recommended (mean cluster recommendation = 6.6). We therefore deemed six the most appropriate number of clusters. Data were clustered using the Partitioning Around Medoids method.

Using R package “compareGroups” (Subirana, Sanz, & Vila, 2014), we performed a univariate analysis, with cluster allocation as the response variable, to explore the statistical importance of different terms in allocating observations to each cluster. We also described each cluster qualitatively, and performed *t*-tests, where relevant, to understand the differences between individual clusters.

3 | RESULTS

3.1 | Part A: Normative belief structures in Kenya and Zimbabwe

To understand regional variation in normative beliefs, we compared belief structures in Kenya and Zimbabwe. Our survey recorded participants’ responses to normative statements such as “my community feels I should bring

my livestock into a boma every night.” Factor analysis of the Kenyan data revealed that normative questions mapped onto four factors (see Table 2). Factor analysis was then performed on the Zimbabwean data, with the analysis was constrained to produce four factors. A Tucker coefficient test showed a similarity of 0.95 between the two factor structures. This is highly similar, and these livestock management normative belief structures can be considered virtually identical. The same analytical approach was carried out using control beliefs, and yielded a Tucker coefficient of 0.79, so control belief structures between the two sites have no measurable similarity. We conclude that normative belief structures are unusually conserved, and therefore approaches using norms to promote effective livestock management may be highly transferrable.

3.2 | Part B: Normative belief clusters in Kenya and Zimbabwe

Individual normative beliefs are not homogenous within a community; we used cluster analysis to understand whether our respondents could be classified into groups of like-minded individuals. Compiling all normative beliefs from Zimbabwe and Kenya, our cluster analysis revealed six relatively distinct clusters, each with different normative beliefs (see Figure 1). To understand the factors that most differed across the clusters, we ran a univariate analysis. All terms, including demographic, social, and normative terms ($n = 21$) emerged as

TABLE 2 Attitude factors

Factor	Description	Example
Factor 1	Herding and perceptions of community management	People expect I will herd my livestock every day.
Factor 2	Perceptions of livestock management locally, regionally, and nationally	Community elders think it is very important for me to manage my livestock well.
Factor 3	Boma use norms	My community feels my livestock should be brought into a Boma every night.
Factor 4	Perceived behavior of loved ones	The people I care about herd their livestock every day.

Note: Factor mapping of normative livestock management behavior questions, using all Kenyan data. Each factor represents a distinct attitude dimension, onto which a set of specific questions map.

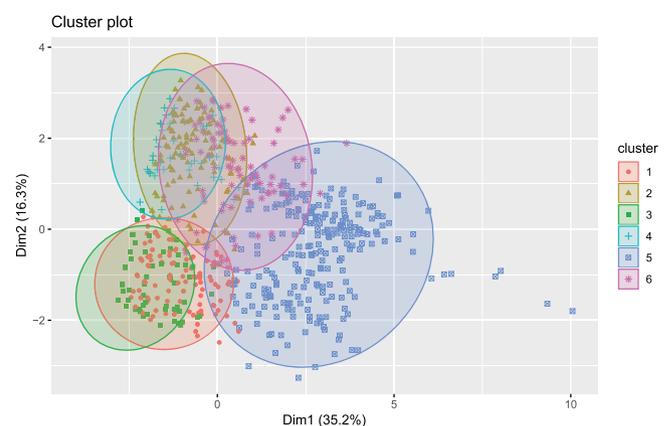


FIGURE 1 Normative belief clusters. A total of $n = 980$ samples, from across southern Kenya and north-western Zimbabwe are plotted using a partitioning around medoids approach. Dimensions 1 and 2 account for a total of 51.5% of total variation; other dimensions not shown on plot. Clusters named as follows: 1—Kenyan traditionalist leaders; 2—Educated modernists; 3—Disadvantaged defenders; 4—Alternative livelihoods; 5—Disadvantaged and disgruntled; 6—Educated, sceptical women

significant ($p < .05$); however, predator killing (both subjective and descriptive terms), country, sex, leadership, and access to food were all highly significant ($p < .001$). Due to the statistical favorability of a smaller number of factors, the "country" term should be viewed proxy for all the social and cultural differences between Kenya and Zimbabwe which are otherwise unaccounted for. In individual clusters, terms had varying importance in their ability to characterize the group. We compared cluster characteristics and performed t -tests to understand how these salient characteristics differed by cluster.

3.2.1 | Cluster 1: Kenyan traditionalist leaders

Slightly older, mostly Kenyan men (92.1% male, vs 76.0% in the overall data, t test: $p < .001$; 98.4% Kenyan; 12.1% of respondents 69–81, vs 7.4% in the general data), often in positions of leadership (46.3% vs 31.4% in overall data, t -test: $p < .001$). These individuals strongly agreed with all predator-killing norms (e.g., 96.3% agreed or strongly agreed that "my community feels I should kill any predators that kill livestock" vs. 51.3% overall, t -test: $p < .001$). All predator-killing norms were statistically stronger in this cluster than the general population. This cluster may represent individuals who practice traditional Maasai pastoralism and predator control, who may often be in positions of local esteem.

3.2.2 | Cluster 2: Educated modernists

This cluster had an approximately even number of Zimbabweans and Kenyans (Zimbabweans = 55.9%). This group was relatively educated, and only 20.6% of members had never attended school (compared to 38.1% in the general population; t -test: $p < .001$); there was also a greater instance of higher education, with 28.7% of respondents having attended secondary school (vs 21.0% overall; t -test: $p < .001$), and 6.6% having attended university (2.5% overall; t -test: $p = .03$). However, despite this, they hold relatively few leadership roles (19.9%, vs 31.4% overall; t -test: $p < .001$). They were cautious in their judgement of livestock production standards, and agreed less than average with statements such as "Kenyans/Zimbabweans carry out good livestock management" ($p < .001$). They were also less accepting of predator control norms than average; for example, only 11% of respondents agreed or strongly agreed that "people expect that I will kill any predators that kill my livestock," compared to 45.7% at large. All predator control norms were less supported by this group than the

overall population (all t -test: $p < .001$). We believe this cluster represents individuals with somewhat educated, modern values, who place relatively little value on traditional livestock management, and may understand the benefits wildlife—including predators—can bring to communities.

3.2.3 | Cluster 3: Disadvantaged defenders

This cluster was Kenya- and male-skewed (95.4% men, compared to 75.6% overall; t -test: $p < .001$), with lower education levels (71.1% never attended school, compared to 35.6% at large; t -test: $p < .001$). This group had very strong beliefs that local, regional, and national livestock management are of high standard: 93.4, 89.5, and 90.1% thought that all members of each respective group "manage their livestock well", compared to the general population results of 43.5, 33.1, and 36.3%, respectively (all t -test: $p < .001$). In a perhaps related component of their psychology, this cluster also exhibited strong support for predator killing, strongly agreeing with the injunctive (should: 87.5%), descriptive (do: 80.9%), and subjective (key people/groups: 71.1%) norms regarding "kill[ing] predators that kill livestock," compared to 31.4, 26.8, and 25.8% of the sample overall. Although similar to Cluster 1, this group did not benefit from the advantages of the first group, for example, leadership roles. With their strong normative traditional practices, we characterize this group as typical male community members in traditional roles, who are defensive of their way of life, and may be unable access to other opportunities.

3.2.4 | Cluster 4: Alternative livelihoods

This group had a near-even split between Zimbabweans (56.2%) and Kenyans. Despite few members being in positions of leadership (17.1% vs 31.4% overall; t -test: $p < .001$), members of this cluster experienced significantly fewer incidences of food shortage than participants overall (20 vs 51.7%; t -test: $p < .001$), but lower livestock ownership rates (12.4% had no livestock at all, vs 3.8% overall; t -test: $p < .001$); this may indicate that they produce their own crops, or have secure alternative sources of employment. They were broadly against predator control, and in answer to the same questions regarding injunctive, subjective, descriptive, and norms about predator killing, only 26.7, 6.7, and 1.0% of people respectively strongly agreed with normative statements, compared to 31.4, 25.8, and 26.8% in across all the data (all differences

t-test: $p < 0.001$). These individuals are similar to those in Cluster 2, but overall have lower educational levels, higher food security, and lower levels of livestock ownership.

3.2.5 | Cluster 5: disadvantaged and disgruntled

This group had a higher than expected proportion of women (37.5 vs 24% overall; *t*-test: $p < .001$), were slightly younger than average (mean age group of 3.6, rather than 3.8; *t*-test: $p = .12$), and experienced elevated food shortages (69.1 vs 51.7% overall; $p < .001$). Their normative beliefs regarding livestock management practices and standards were less strict than the overall results. For example, strong agreement with the injunctive statements such as “my community feels my livestock should be brought into a boma every night” (22.0%), or descriptive norms such as “people expect I will herd my livestock every day” (11.3%) were much lower than on the overall sample (which supported these examples at 71.8 and 63.0%, respectively). All herding and boma use statements ($n = 6$) had statistically significantly less support from this group (*t*-tests, all $p < .001$). We suggest that this cluster has relatively weak ties to, but are necessarily still reliant on, traditional livestock management. They have similarities with Cluster 3 in terms of social disadvantage, but showed relatively less defense of their existing lifestyles, so may be more open to alternative employment or management approaches.

3.2.6 | Cluster 6: Educated, skeptical women

With the highest proportion of women of all clusters (42.6 vs 24.0%); and a similarly elevated proportion of Zimbabweans (64.8 vs 24.6% overall), this group was highly distinct. They were overall more educated (school was bracketed; mean of 2.3 vs 1.9 overall; *t*-test: $p < .001$) than the respondents at large. Similarly to Cluster 5, they showed low confidence in local livestock management practices, and all norms were less strict (e.g., low agreement with statements such as “my community feels my livestock should be herded every day”) than in the overall population (all *t*-test: $p < .001$). They also had low confidence in management standards, with significantly lower estimates of the proportion of individuals who carried out good livestock management locally, regionally, and nationally than the overall survey population (*t*-test: $p < .001$). They also showed less acceptance or support for predator killing norms than expected, with only 13.9,

13.0, and 6.5% agreement with injunctive, descriptive, and subjective predator-killing norms, versus 51.3, 45.7, and 42.3%, respectively, for the entire sample (*t*-tests, all $p < .001$). This group condemned local livestock management the most strongly of all clusters; with high education levels and more female participants, we suggest this group may be modern in outlook, and may either wish to have greater support in their livestock management, or find livelihood alternatives.

4 | DISCUSSION

To achieve conservation aims, human behavior change is often necessary; despite this, behavioral psychology is seldom integrated into conflict mitigation activities (Baynham-Herd, Redpath, Bunnefeld, Molony, & Keane, 2018). Even where psychology is integrated into intervention planning, achieving behavioral change is difficult. Normative beliefs are one of the key psychological factors that influence behavior, and therefore understanding norms may be critical to designing effective behavioral interventions. In this study, we investigated the structure of normative beliefs in two different populations of livestock owners, to explore whether interventions using norms may be useful in the context of livestock management in sub-Saharan Africa. For most conservation projects, planning, conducting, and analyzing a survey to understand local norms may not be within their in-house capability, so standardized tools are needed if such an approach is to be recommended. We found that livestock management normative belief structures were virtually identical on two very different sites, suggesting that relatively little work is needed to develop semi-standardized tools for exploring local norms.

Another challenge in designing effective conflict interventions is understanding the different social and psychological properties of a population. Human communities are highly heterogeneous, and understanding these nuances may improve the success of conservation initiatives by facilitating targeted interventions. In this study we sought to understand the factors that differentiate sectors of a population, and define psychologically distinct groups using the same normative survey across both study regions. Compiling all normative and demographic questions in the survey, we found that six clusters emerged from the data: “Kenyan traditionalist leaders,” who had traditional perspectives on predator killing and husbandry; “educated modernists,” who were well-qualified and had little interest in predator control; “disadvantaged defenders,” who were defensive of their way of life, but socially disadvantaged; “alternative livelihoods,” who kept few livestock, and engaged with

alternative opportunities; “disadvantaged and disgruntled,” who had access to few opportunities, but were disenfranchised from traditional lifestyles; and “educated sceptical women,” who had little enthusiasm for traditional approaches to livestock husbandry. All core survey questions ($n = 21$) were marginally significant in distinguishing groups, but six terms were highly significant: sex, country, positions of leadership, access to food, and both descriptive and subjective normative beliefs regarding predator killing; in this study, these attributes were key to characterizing the normative belief position of individual respondents.

Overall, two core groups—“traditional leaders,” and “disadvantaged defenders”—were dominated by Kenyan individuals. This may be a result of a distinctly larger Kenyan sample, but regardless, these groups are representative mostly of Kenyan social clusters; with a larger sample size from Zimbabwe, similar groups may emerge. Many Maasai practices, for example seasonal grazing, have considerable conservation value, however modernization of the Maasai—and loss of some of their traditions—is to some extent assumed to be inevitable. Yet the strength of these groups demonstrates how strong Maasai culture remains in the areas included in this survey. Indeed, reinforcing and reinterpreting traditional Maasai practices can be a powerful tool for conservation, for example lion guardian programs, where individual *morans* (warriors) are employed to monitor and protect lions, rather than spearing them (Goldman, de Pinho, & Perry, 2013). Similarly, many conservation entities encourage “cattle banking” (Bote, Mago, & Hofisi, 2014) where individuals can “deposit” their livestock in a “cattle bank,” i.e., a central herd, which is then managed away from conservation areas, with the aim of reducing overgrazing and livestock-related conflicts. The strength of the normative groups in this study suggests that culture and historic practices still play a huge role in identity and behavior, and interventions should seek to integrate these traditional beliefs and behavior into conservation initiatives.

Two groups—“educated modernists” and “alternative livelihoods” had access to non-livestock sources of livelihood. Overall, these groups were critical of traditional livestock management, including predator control. This may in part be due to the “low status” of livestock management as a profession in many populations, an effect which may be exacerbated where people have received more education, as here. However, we cannot disentangle the cause and effect of low reliance on livestock and negative perception of the tasks involved in livestock production: some evidence suggests that a change of behavior may itself lead to a change of attitude (Verplanken & Wood, 2006). In other

words, respondents who themselves have moved to alternative livelihoods may have only subsequently developed poor perceptions of their former, traditional practices. Regardless, the attitudes in these groups suggest that however they came to their alternative livelihoods, they have no desire to return to livestock management. This suggests that transition to alternative livelihoods can result in long-term, sustained attitude change, which itself prevents a reversion to livestock management. Ephemerality of behavior change is a common limitation of interventions, but this result suggests that reduced reliance on livestock may be self-perpetuating, and programs which encourage this transition may have sustained impacts.

We found variation in the level of education received by different groups. Most notable was the presence of a distinct group of more educated Zimbabwean women, which may reflect Zimbabwe's enlightened education policies of the 1980s and 1990s (Chung, 2008). This group had a strongly negative attitude towards traditional livestock management, which may stem from its low status, or simply from the—often unmet—expectation that education would allow individuals access to professional opportunities. Another group which had a high proportion of women (“disadvantaged and disgruntled”) had a similarly negative attitude towards traditional models of livestock management. Whether women in general favor more modern livestock management strategies, dislike livestock management, or are more averse to conflict—including predator control efforts—remains to be determined. Women in the study populations traditionally have little control over livestock management decisions, and may feel low levels of ownership of this activity (Kristjanson et al., 2010). The notable difference in attitudes between female- and male-dominated clusters suggests that livestock management interventions should be adapted to specific groups. In particular, female-headed households may be amenable to using improved management techniques or alternative sources of livelihood.

Communities are often viewed as monolithic entities, but this study has illustrated that distinct social clusters are present within communities, and that these clusters have different social, demographic, and attitude-based attributes. One-size-fits-all conservation interventions are a myth, and a growing body of work shows that adapting interventions to local social conditions is critical to their success (St John, Edwards-Jones, & Jones, 2011; Waylen, Fischer, McGowan, Thirgood, & Milner-Gulland, 2010). Understanding how to divide a population into discrete units, whose members have different attitudes towards interventions may substantially improve the efficacy of said programs. From

even this brief study, certain salient results emerge: Maasai culture still has very deep roots in the attitudes of people across southern Kenya; conservation interventions must work with these beliefs to be effective, but can also target the distinct population sectors who feel there are shortcomings in the traditional lifestyle model, who emerged in Cluster 5 of this analysis. Women and female-headed households also had a distinct set of attitudes, and little appreciation of traditional livestock management; programs to provide either alternative sources of livelihood for women's groups, or encourage and support modern approaches to livestock management may prove particularly effective. While these suggestions are broad, we use them as examples to illustrate the insights that can be generated from even relatively limited social studies. The needs and issues experienced by different segments of a community are different, and therefore so are their interactions with conservation schemes; multiple approaches are needed to address the needs of these different societal groups, and targeted approaches informed by social studies are highly recommended.

A recent review of HWC interventions found that only 40% of studies recommended implementation approaches with a cognitive (i.e., behavioral psychology) component (Baynham-Herd et al., 2018). This is surprising, given the growing body of evidence which shows that psychology, particularly normative beliefs, can influence individuals' conservation-related behavior. An understanding of normative behavior is likely to be useful in designing conservation interventions. Previous research into human-predator conflict has shown that norms can partially explain intention to kill jaguars (Marchini & Macdonald, 2012), support for mountain lion protection (Davenport, Nielsen, & Mangun, 2010), and willingness to prevent conflict with leopard (Jhamvar-Shingote & Schuett, 2013). With this study, we have shown that normative beliefs relating to livestock management are highly similar between different regions, and that the same survey tool was effective in capturing local norms in both populations. In practice, this means that studies or interventions seeking to use norms to understand HWC may be able to make use of normative study "templates" to aid in the design of their approaches. While we recognize that further work is required to understand the mechanisms and optimal design of norm-based interventions, our results indicate that relatively simple, standardized norm surveys may provide critical information on the social dynamics of communities, and that integrating the resulting data into intervention design may ultimately result in more successful conservation outcomes.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Laura R. Perry and David W. Macdonald conceived of the idea. Laura R. Perry designed and carried out data collection, aided by Lovemore Sibanda and funded by a grant held by Andrew J. Loveridge. Laura R. Perry wrote the manuscript with substantial input from Andrew J. Loveridge, and further input from all co-authors.

DATA AVAILABILITY STATEMENT

All data deposited on Open Science Framework, under DOI: 10.17605/OSF.IO/WX6UE. Data accessible at https://osf.io/wx6ue/?view_only=85f41855508545b6ae292920f47f9a39.

ETHICS STATEMENT

All research was carried out under University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (reference number R53944/RE001).

ORCID

Laura R. Perry  <https://orcid.org/0000-0002-9860-4528>

Lovemore Sibanda  <https://orcid.org/0000-0002-4960-9242>

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